

Deviation NVC-02-DV
HOVWS Alignment – Compound Curve Radii

I-5/SR 16 Interchange/Construct HOV Connections

September 2015

MP 131.35 to MP 133.54

XL 2078 PIN 300566A

This **Deviation Request** has been evaluated and documented in accordance with Washington State Department of Transportation manuals and current design standards and procedures.



Project Engineer

9/9/15

Date



☐ Deviation Approval Recommended ☒ Deviation Approved



Project Development Engineer – Olympic Region

10/5/15

Date

Introduction

The 2003 Nickel funding package and the Transportation Partnership Act of 2005, along with Federal funding for design, funded the project entitled "I-5/SR 16 I/C Nalley Valley Interchange." This project proposed to realign and improve SR 16 in the Nalley Valley area of Tacoma and modify the ramp connections at the I-5/SR 16 interchange. This included replacing the former viaduct with new structures, reconstructing all ramp roadways and structures, reconstructing northbound and southbound I-5 on new split alignments with inside HOV lanes, and constructing freeway-to-freeway HOV connections. This work was to be done through three separate construction contracts as part of the Tacoma/Pierce County HOV program. The first two of these projects were SR 16 Westbound Nalley Valley (completed June, 2011) and SR 16 Eastbound Nalley Valley (completed August, 2014). This project will complete the interchange using the funding sources cited above.

I-5 is classified as an interstate. Both SR 16 and I-5 are classified as NHS routes.

Project Overview

The *I-5/SR 16 Interchange – Construct HOV Connections* project will complete the reconstruction of the interchange, which will allow HOV-lane travel on SR 16 from I-5 to the Narrows Bridge, and on I-5 from SR 16 to Seattle. This is an II Urban Mobility project which is the final of three stages.

Existing Conditions

The proposed project is located within the City of Tacoma in Pierce County. I-5 currently has three 12' lanes northbound, four 12' lanes southbound, 10' outside shoulders, and 6' inside shoulders in the project vicinity. The two I-5 traveled ways are separated by pinned concrete barrier. The current Average Daily Traffic (ADT) on I-5 is 190,000, based on a 2014 count. The projected ADT for the year 2030 on I-5 is 278,000. The interchange, prior to the first two Nalley Valley projects, operated at Level of Service E.

Proposed Design

The I-5/SR 16 Interchange – Construct HOV Connections project will reconstruct I-5 in both directions through the interchange, separating the roadway to provide a sufficient median width for direct HOV ramps between I-5 and SR 16. The location of the I-5 corridor will not be changed. The direct HOV ramp between eastbound SR 16 and southbound I-5 (HOVWS Line) has a proposed alignment with a compound curve just prior to the end of the alignment, where it merges with southbound I-5 (LS Line).

Design Data	I-5	HOVWS
Functional Class	I-1	P-1
Design Speed	60 mph	45 mph
Posted Speed	60 mph	n/a
Land Use	Urban	Urban
Terrain	Rolling	Rolling
Design Vehicle	WB-67	WB-67
Truck Percentage	8.6%	n/a

Deviation Description

Design Element –

Compound curve radii.

Proposed –

The proposed HOVWS alignment has a compound curve with respective radii of 1500' and 3000'.

Design Standard -

DM 1210.04(1)(f) indicates that when compound curves are used, make the shorter radius at least two-thirds the value of the longer radius. Chapter 3, page 3-112, of *A Policy on Geometric Design of Highways and Streets* (2011 AASHTO Green Book, 6th Ed) has the same criteria, plus the additional guidance that on one-way roads, such as ramps, the difference in radii of compound curves is not as critical if the second curve is flatter than the first.

Alternatives Considered –

Alternative #1- Revise the design to meet Design Manual criteria;

Revise either of the curve radii so that the two-thirds design standard in the WSDOT Design Manual is met. This could be done by shortening the radius of the second curve so it does not exceed 2250', or increasing the radius of the first curve to at least 2000'.

This alternative is not proposed because:

- The HOVWS ramp is immediately adjacent to the HOVSW ramp, which is the direct HOV ramp from northbound I-5 to westbound SR 16. The ends of the HOVWS alignment, at the limits of the compound curve, can't be shifted due to connecting to the HOV16 ramp to the north and merging with mainline I-5 (LS Line) to the south. Increasing the radius of the first compound curve is not possible, as it would result in a conflict between the two HOV ramps.
- The HOVWS/LS merge is a parallel-on design (DM 1420.05(6)(a) (July 2013)). Decreasing the second compound curve radius would increase the superelevation on the ramp LS, where the parallel gap acceptance portion of the on-ramp begins, and is in a crown section (2% slope). If the second ramp was decreased, the ramp would have a superelevation of 6% to 7%.

Alternative #2- Provide geometrics as proposed;

Provide the proposed geometric design. This is considered feasible because:

- It is compatible with the adjacent alignments (LS and HOVSW).
- It meets the Note 3 of DM Ex. 1360-13b (June 2009), which indicates a transition curve of 3000' is desirable prior to the parallel portion of the ramp.
- AASHTO criteria is met; the second curve is flatter than the first.

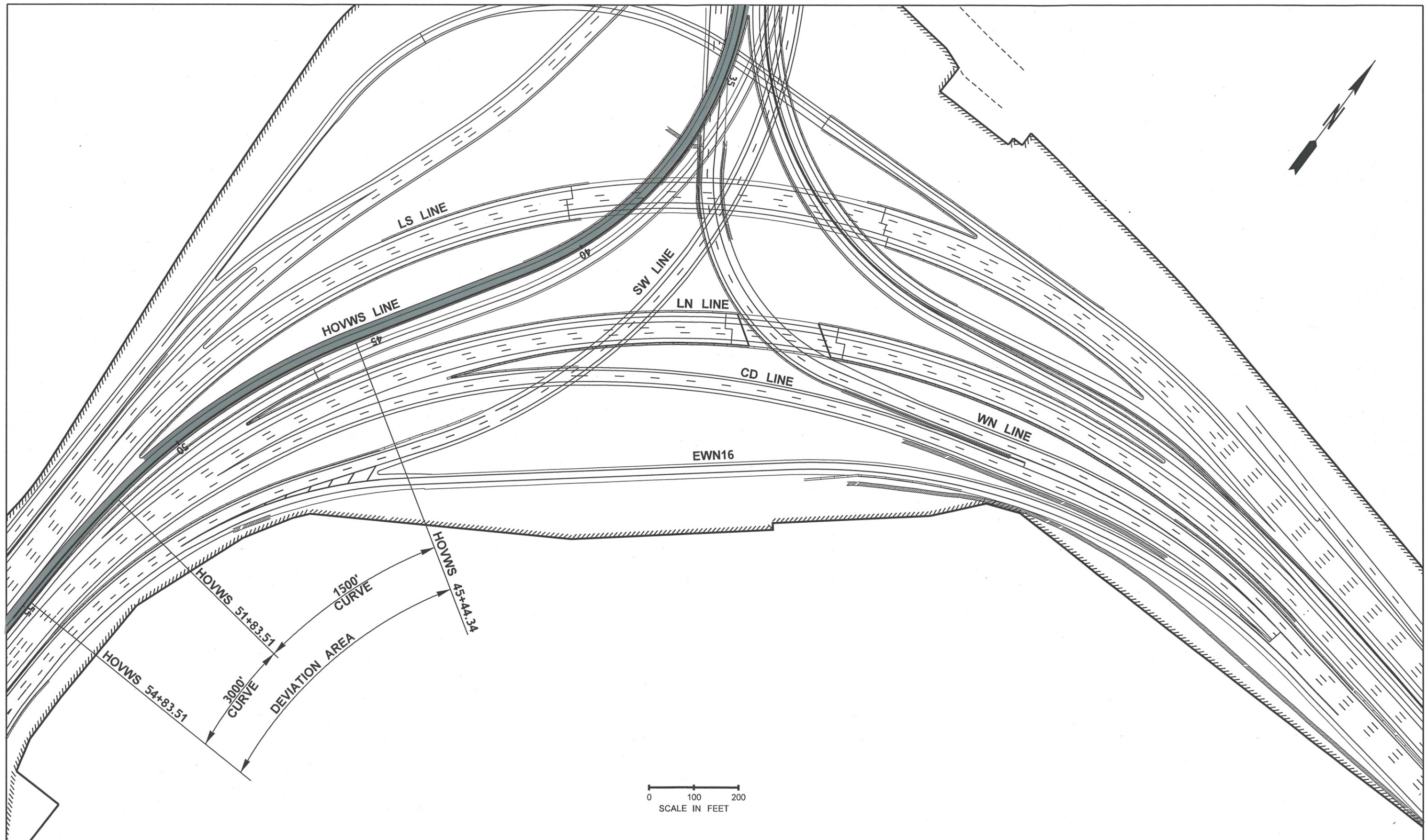
Justification


Realigning the HOVWS ramp to increase the first compound curve radius to meet design criteria would adversely impact adjacent existing alignments and structures, and would result in demolition and re-work of recently constructed facilities at a significant added cost.

The proposed design fully meets AASHTO standards for compound curves when the second curve is larger than the first.

Recommendation

The recommendation of the Olympic Region is to deviate compound curve design on the HOVWS Line from the WSDOT Design Manual standard and conform to the AASHTO standard. The design will provide a compound curve where the second curve has a radius twice the length of the first curve. The Olympic Region bases the recommendation on limited room in which to vary the design, based on the urban nature of the interchange and the recently constructed adjacent facilities, and engineering judgment. The Olympic Region proposes to build this section of the HOVWS alignment as currently designed with compound curve radii of 1500' and 3000'.



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TIME 12:46:41 PM	DATE 9/9/2015	JOB NUMBER		LOCATION NO. XL2078	SHEET OF SHEETS						
PLOTTED BY JaquetJ	DESIGNED BY M. ROOS	CONTRACT NO.		DATE		P.E. STAMP BOX		DATE		P.E. STAMP BOX	
ENTERED BY J. JAQUET	CHECKED BY R. BAUGH	BY		REVISION		DATE		DATE		DATE	
PROJ. ENGR. B. CLARKE	REGIONAL ADM. K. DAYTON										